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AUTHOR Crowther, Warren
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ABSTRACT

The low efficacy of many of the library and large-scale information systems that have been implemented in the developing countries has been disappointing, and their appropriateness is often questioned in the governmental and educational institutions of more industrialized countries beset by budget-crunching and a very dynamic transformation of information requirements. This article examines the conceptual and practical deficiencies of current misapplications of the systems approach, which result in inappropriate or disappointing systems. It suggests that more importance should be given to the analysis of opportunity costs and contingencies when scarce resources are at stake, and to the consideration of the complex objectives of the institutions that are to benefit from these systems; the choice of information technologies and the economic evaluation of the options must respond to these conditions. It is also suggested that action research principles can help overcome many of the conceptual and practical problems in systems analyses. (Author/KM)

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CONSIDERING COMPLEX OBJECTIVES AND SCARCE RESOURCES IN INFORMATION SYSTEMS' ANALYSIS

Warren (Win) Crowther,
United Nations Department of Technical Cooperación, Central American Public Administration Institute*

Synopsis: The low efficacy of many of the library and large-scale information systems which have been implemented in the developing countries has been disappointing, while their appropriateness is questioned more often in the governmental and educational institutions of more industrialized countries beset by budget-crunching and a very dynamic transformation of information requirements. This article examines the conceptual and practical deficiencies of current information system analysis, leading to inappropriate or disappointing systems. It suggests that more importance needs to be given to the analysis of opportunity costs and contingencies when scarce resources are at stake and to the consideration of the complex objectives of the institutions which are to benefit from these systems. The choice of information technologies and the economic evaluation of the options must respond to these conditions. The article also suggests that action research principles can help overcome many of the conceptual and practical problems in systems analysis.

The purpose of this paper is to revive interest in some classic characterizations, as opposed to the popular versions, of the systems approach in the design of information systems. In addition, it is argued that the principles of action research offer a practical solution to many of the dilemmas which have led to the misapplication of the systems approach.

THE PROBLEM

The systems which are designed using diluted and distorted versions

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*The opiniones expressed in this article are the exclusive responsibility of the author, and are not to be associated in any way with the organizations with which he is associated. The author is grateful to Dr. Homer Hall and the students of the Central American regional MPA program for their observations on the original draft of this document.

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of the systems approach are not apt for "production situations"** with complex objectives and with scarce resources. As a result, the propagation of these systems leads to skepticism, especially in the developing countries, regarding the potential usefulness of information systems in general.

Part of the problem is the loss in practice of some of the classic tenets of the systems approach and of general systems theory,(1). Part of the problem is the incorporation of diagnostical techniques, design concepts and a choice of information technologies which incorrectly presume an ideal situation: (a) of a reduced quantity of potentially coherent and relatively stable objectives of the production situation which is being analyzed, (b) of easy acceptance or compliance in that situation with technical rationality (2) and (c) of an expanding and generally sophisticated resource base to sustain the information system. This ideal situation does not exist in Latin America.

More concretely, the information system analyses observed by this writer during 15 years in Latin America, including the analyses prepared by local analysts and by United States, Canadian and European consultants to the region,(3) have been deficient in at least five interrelated ways: (I) distorting or diluting the systems approach; (II) not confronting directly the inherent contradictions of "information systems" nor making explicit the choices which in fact are made regarding these contradictions; (III) misappropriating General Systems Theory; (IV) oversimplifying the problem

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**We shall refer to the situation for which an information system is to be inserted or improved as a "production situation". The emphasis is on the production, for the direct consumption or use in the society or to defend its interests, of goods, services, security, standards, orientation and information. Our primary interest is in the "production situations" of public institutions and programs, but most of the observations in this article are relevant to the private sector as well.

of systems analysis objectives; and (V) being unrealistic regarding the scarce resource situation.

I. The very characteristics which Churchman most recently identifies with the systems approach are absent in most of the observed analyses.(4) These misapplications are:

1) Adopting narrow definitions of relevance for the choice of solutions, limited (a) to information quality, communication effectiveness or bureaucratic efficiency rather than organizational or programmatic efficacy or the efficiency from the client's point-of-view of the organization or program and the information handling capabilities of the information users, (b) to running the system rather than solving policy and administrative problems, (c) to structural modifications rather than real changes in the people or production of the work situation, or (d) to formally enunciated objectives for this work situation, or a coherent and reduced set of objectives which are derived by management-by-objectives techniques, rather than an exhaustive identification of all the interests and intentions which are present or will be present in the situation and their respective "information values".(5)

2) Letting surrogates substitute for those who should really benefit from the systems, applying conventional definitions of the "users" (those who receive the information), and not making a clear distinction between these and the "beneficiaries" (those who should benefit from the existence and working of the system) and with the "clients" (those who request or sponsor the system), or a clear identification of possible value conflicts among these groups.

3) Opting for simplistic solutions which only deal with symptoms of the real problems, and which ignore the contingencies which condition the efficacy or even just the implementation of the solutions;(6)

4) Offering little imagination in the identification of real opportunities to change things, or in variations on the composition or use of commercially-available technological packages;

5) Excluding opportunity cost considerations with regard to all the resources which are to be applied (which is particularly grave in developing countries with regard to such resources as management capabilities and certain types of information analysis and processing abilities);

6) Not building in a permanent learning mechanism or self-destruct mechanism (this latter, to overcome inertia in the face of obsolescence) into the system;

7) Exercising little rationalization of the inquiry effort, so that the analysis itself is (a) overly concerned with factors which turn

out to have little importance, (b) insufficiently discriminatory regarding the detail of information on different objects or the amount of "analysis" of that information, (c) deprived of what a full (and agil) exploitation of existing data tables and bases and documents could offer, and (d) in general a poor example of organization of an activity in terms of priorities (while supposedly trying to resolve that very problem for the client or user of the system);

8) Not conceptualizing the ethical and political role of the analyst, and the importance of personal consciousness regarding the values he or she is (inevitably) introduccing into the situation and regarding the real intentions which underlie his or her "intervention" in the situation;

9) Presuming that if the systems do not function as they "should", the fault lies with "political interferences", cultural or religious values or managerial incompetence, rather than with the design that did not take these "realities" into account or with a design methodology that was not sufficiently interactive with the users, clients and beneficiaries of the system.(7)

II. The observed analyses fail to recognize and come to terms directly with such basic and practical dilemmas of an "information system" as the following:

1) That "communication effectiveness" or "relevance in retrieval effectiveness" or "rational information adquisition policy" are useful but easily misleading criteria, in that they tend to reinforce the preconceived notions and standardize thinking of the users, rather than open lines of really new communication, broaden thinking or perturb existing notions.(8)

2) But then, in general, a decrease in redundancy in information tends to increase the probability of incomprehension of new information among the receivers, unless there is receptivity to tacit knowledge and the information is transmitted accordingly.(9)

3) To what extent the expectation is that behavior in the production situation being analyzed be adjusted to the system model's categories, and to the classification and qualities of the information which is to flow in the system, or to what extent these categories, classifications and qualities should be adapted to the "realities" and real information requirements of the situation. Naturally, this is an especially pertinent question in cases of packaged or "turn-key" information system transfers.

4) If the decision or organizational support function assigned to the information systems should be like that of a classical systems engineer in stessing the imaginative obtaining of resources in order to comply with the pre-established goals of the organization, or like that of a Third World economist in ignoring sunk costs and stressing

opportunity costs, or like that of a legalist stressing strict adherence to pre-defined commitments, norms and other formal documents, or like that of statesman in taking into account all the interests that the State or nation should defend, or like that of a politician in helping to negotiate consensus among conflicting interest groups.(10)

5) The interpretation of a decision function in terms of a decision table or a classification and the computerization of that table or classification are forms of delegation and thus imply a certain loss of managerial flexibility, even while these activities are justified as measures to enhance "control".

6) As a corollary to the previous point, the usefulness of an information system intended to enhance management (or any other type of) control can be null or negative if it is lacking just one of the components of a complete control system: reliable inputs, a selection of relevant inputs and rejection of the useless ones, competent evaluation, a "good" but selective memory, evaluation criteria constantly adjusted to "reasonable expectations" regarding the controlled activity, clear pinpointing of "exceptions" (for decision by exception), clearly-defined authority to determine resource reallocations or new instructions to the controlled activity and communication effectiveness throughout the control cycle. However, the costs to assure all these components often greatly exceed the benefits, and the effort and skills required to mount and maintain all this exceed capabilities.(11)

7) Information quality is not necessarily correlated with the amount of authority which the information source has for the user, and it is this latter which more assuredly determines the use of the system, if not it's usefulness.

8) An information system intermediates in a relationship of power between source and user, and if these are not identical (the same person) then it is almost impossible to handle sensitive (read: really important) information and satisfy both the source and the user; the source closes up if that information is transmitted (thus the source's true failings are exposed) and the user loses interest if it not. However, when the source and user are the same, it is typical for a vicious circle to set in whereby the source (also the user) laxes on input quality, the processor receives and produces trash, the user (also the source) loses confidence, and both as source and user loses interest.

9) The information system is the modern apparently easy way to introduce new knowledge in a situation that needs it, and supersedes or complements other ways, such as training, recruitment, technical cooperation, consultancy, research, etc. Yet the implementation of an information system usually requires a very strong and sophisticated input of precisely these other mechanisms.

10) However "data" and "information" are distinguished, an information system must provide the latter, and that information must be translated into knowledge, skills, production, production

efficiency and production efficacy in the production situation. In this process of conversion of data into information and then into information impact, whichever key functions are not absorbed by the analysts, machines and information workers must be assumed by the user or other persons in the communication channels. In practice, then, when the formal information system components are not "ready" to take on determined functions (like adaptation of the classification to the users' needs or like document delivery), then these functions must be taken up by the user or other persons who naturally can be even less prepared to do so. The result often is a partially functioning system with no real impact at all.

III. Now, while doubt is raised about the appropriateness for analyzing information problems of various classical tenets of General Systems Theory, including some concepts influential in Information Theory, other tenets need to be resuscitated for a coherent and relevant application of the systems approach to information systems. On the one hand, it is more apparent than before that information is not necessarily negentropy (turning around entropy or disorder), nor does it necessarily contribute to certainty (unless one entertains a tautology by defining information as those data which create certainty). It is not clear that negentropy, or order or certainty, or homeostasis nor even a "steady state" are virtues which information should produce in political environments which have little decision autonomy or limited options to redress great wrongs through non-revolutionary action. Doubts are also in order about information's supposedly inherent quality of producing change or of stability, but it is important to recognize its enormous potential as an ally (or enemy) to other elements in a production system. In other words, the system integrity or output value of an "information system" or "library system" depends directly on the interests which are served and on the contribution to larger systems-- society, communications, learning, production, etc.-- to which the above mentioned concepts might be more applicable in determined cases.

On the other hand, there is much to be said for the application to the production situation and to the role of information in it of such principles as equifinality, health (or preferably, healing), Gestalt (the whole is greater than the sum of its parts), dynamics (changes and interventions), requisite variety, and attention to symbolism, awareness and human communication, and to man's potential for independence, creativeness, spontaneity and playfulness. These principles can help turn around the sad reality of the impact of decades of information system developments: As opposed to an abundance of closed systems, "Examples of relatively open communicaton systems in the Western world are more difficult to come by".(12)

IV. The simplified systems analyses have not come to terms with the complex objectives they need to address. It is important to differentiate (a) the objectives defined for the production situation which could be improved by an information system investment; (b) the quality, authority and other values of the information for the user and for the user's production situation; (c) the impact of the information system on the users, on their environment and on the systems' own operating environment; and (d) the intentions or objectives of the analyst regarding the immediate impact of the analysis itself on the situation.

The first set of objectives, which are or need to be defined for the production situation which is to benefit from an information system, should be applied as well to the information system itself. In other words, the criteria of utility and performance of the information system are found in the objectives of the production situation, with emphasis on the efficiency and efficacy of this production. Either the new system is supporting the

capabilities of the production situation to define a positive role in dealing with the society's structural problems and crises, or it is reinforcing unfortunate distractions and uses of scarce resources in less-critical matters. The real "decision support" is the support for decisions which deal with the most important application of the society's resources, and not just new information system outputs in themselves.

Nonetheless, the second set of objectives, regarding improvements in information quality and authority, although not valid in themselves as indicators of the usefulness or use of the system, are important as system design requirements, since they determine if the system really can be used and if the information really has the needed performance potential.

The third set of objectives calls attention to the changes in the people and in the programs of the production situation, for these should be the real beneficiaries of the information system. It is not just the access to quality information and its timely delivery which are important, but the overall impact of the introduction of a new information system on the communication, socio-political and production systems into which the information system is being nested. The very presence of new information flows and services which alter or reinforce patterns of searching and processing information in the individual or in the production unit, is in itself a "disturbance" of these more basic systems, or it is a contribution to the growth of at least some of the interests involved, independent of the particular information outputs. There should be concern with the information gathering, storing, processing and interactive communication capabilities of the individuals and production units.

The fourth set of objectives, regarding the impact of the analysis

itself on the situation being analyzed, is of particular interest here, since this depends directly on the choice of methods. The major point is that what happens during the analysis can be as important if not more important than what happens as a consequence of it. Also, the way the analysis is carried out has strong ethical and epistemological implications, as well as determining the analysis' effectiveness.

The four types of objectives are seldom addressed in current systems analysis. In fact, we do not know of any method which deals explicitly and adequately with all four types.

V. The simplified systems analysis does not face up to the severity of resource scarcity and the never-ending fight to obtain resources even for programs which have resource commitments (budget, personnel, foreign exchange, political support, administrative backup) in principle.

Information system design, including technological selection, needs to deal with a number of real resource deficiencies, which are not likely to be overcome in the near future in the Third World and which in fact could be more severe than is usually recognized and become increasingly severe in the industrialized world.

In other words, the crisis atmosphere which brings forth new critically important factors that take precedence over studied technical considerations and over popular technical solutions, is not a temporary situation. Actually, much of the Third World is suffering more than a crisis; it is engaged in a long-term deteriorating and flight (and in some cases, rip-off) of production capacities. These countries simply do not have the decision autonomy, managerial capacity or margin of error (risk-absorption capacity) to be able to struggle with basically static,

doubtfully useful and terribly expensive information systems conceived with a technical rationality which falls so short in the terms set out in this article, especially in not being adapted to political realities.(13)

In a scarce resource situation,(14) the analyst must take into account not only the unsophisticated users (as mentioned earlier, ironically appearing to need well-developed services to compensate for their lack of sophistication), users who are unstable in their work functions and the scarcity of financial resources, but also the difficulties of access to: (a) more than a small part of the technology which is offered in the "world (meaning larger cities of industrialized countries) market", (b) adequate documentation, software, maintenance and computing backup for the hardware which is offered, (c) reference librarians and others who can facilitate user access to documents and data, (d) relatively rapid retrieval from international data bases, at costs which are within reach of the poorly paid user, (e) opportune document delivery rather than just references, (f) sophisticated indexing capabilities, (g) classifications adapted to the local needs or persons who can adapt the classifications to these needs, (h) local administrative procedures compatible with the support needed by sophisticated information systems, (i) well-trained and constantly updated information managers and systems' analysts, (j) training and other current information science materials in the local language or in a terminology that can be understood by the available level of information worker and (k) continual executive attention, patience and support for information system developments as opposed to all the other things that the top administrator must attend.(15) This partial list is sufficient to suggest the international pertinence of hypotheses regarding computing application transfers among local governments in the United

States: "transfer probably is inappropriate as a quick means of upgrading low sophisticated sites...; the benefits from transfer are less and the costs greater than the proponents acknowledge".(16)

A very important aspect of the choice of technologies and delivery systems is that the proposed systems not require the transfer of scarce human, material and financial resources from other greater needs for them in the country or institution. It is curious that the concept of opportunity costs, in contrast with direct and indirect costs, receives so little attention in the developing countries. Projects are seldom confronted or compared, in order to determine the relative importance of them for scarce resources. As a result, the projects already approved and theoretically financed must in fact compete for such scarce resources as good project administrators, foreign exchange, national counterpart funds, training facilities, working space or executive attention when things go wrong. These types of factors are not duly clarified in the form of shadow prices. The problem is that external and internal political interests in a tight resource situation are not prone to accept technocratically-defined priorities nor do they accept a centralized or coherent political definition of these priorities. Neither the political system nor the planning system are structured nor disposed to assure that project commitments are scaled to implementation capacity in a developing country, and the real priorities then are established according to the relative skill of project administrators in dealing with bureaucratic procedures which are necessary to control these scarce resources and which often unfairly receive the blame for delays.

The contingencies and opportunity costs mentioned here have to be

anticipated, along with all the other factores which limit the capacity of a "less developed country" or other relatively resource-poor area to accept sophisticated systems. Given the paucity of studies or theory for these situations, action research principles offer the great advantage of determining "on-site" the real all-around feasibility of a system. This form of analysis is intended to make to most of a very bad situation, with placing emphasis on relevance, rationalization of the analytical effort, immediate and constant feedback from the situation regarding acceptance of possible solutions, negotiation of the resources needed for these solutions and methodological rigor to avoid illusionary expeditions.

A POSSIBLE ANSWER: ACTION RESEARCH

For all five types of deficiencies of current systems analysis, the principles of action research appear to offer at least a partial remedy.(17) It is a matter of making the principles explicit and applying them consciously. In fact, in addition to the ICAP (Instituto Centroamericano de Administración Pública) methodology which attempts to take all of these principles into account,(18) other information system and organizational analysis methodologies (all of which emphasize the determination of information requirements in organizations, programs or projects), including a few presented at the 1982 IFIP Working Conference on Comparative Review of Information Systems Design Methodologies, adopted some of these principles and have developed techniques for applying them. The methodologies are:

SSM- Soft Systems Methodology (19)
ISAC- Information Systems work and Analysis of Changes (20)
ACM/PCM- Active and Passive Component Modelling (21)
JSD- Jackson System Development (22)
STRADIS- Structural Analysis Design and Implementation of Information System- System Development Methodology (22)
INCAE- Instituto Centroamericano de Administración de Empresas (23)

PIP/LF- Performance Improvement Program of the United Nations and Logical Framework (24)
Delphi Method (25)
ID- Influence Diagrams (26)
PROPLAN (27)

The principles of action research, and examples of their application, are as follows:

1) The essence of the analysis is the contrast between the values of the people (the "subjects") involved in the production situation which the information system is meant to support, those of the client of the analysis, those of other observers and interested parties and those of the analyst. This contrast is the essence of analysis. The analyst's conceptualization of the situation, the data gathering and the development of greater consciousness and a more coherent conceptualization of the situation by the people involved in it, should be interrelated during the implementation of the analysis and not be conceived as a 1-2-3 sequence. There is a great deal of flexibility, imagination and participation in the choice of indicators used to evaluate the situation. (This is a basic focus of SSM, ISAC and the Delphi Method).

2) The analyst always is intervening in the situation he or she is analyzing. This intervention can be that of a catalyst, promoting the clarification and convergence of values of the people involved in the working situation, and perhaps of the client as well, or in varying degrees the analyst's own personal values and interpretations can be introduced. In almost all cases, during the analysis the analyst's own values are highly influential in the situation being analyzed. At the least, he or she should be aware of how this influence permeates and what effects it produces in each object or subject of analysis. (This is attempted in the Delphi Method and PROPLAN.)(28)

3) The analyst has a special responsibility towards the "subjects" of his or her analysis, and for the consequences of the analysis on them, on their modes of thinking, on their behavior and on their very employment and self-realization. The analyst's real intentions regarding the impact he or she desires to have on the "subjects" during the analysis and their working environment should not only be conscious but also ethical, and the strategy of implementation of the analysis itself should reflect this consciousness and ethic. (None of the methodologies reviewed apart from that of ICAP appear to give much attention to ethical considerations in the analysis activity itself, apart from attention given in some cases to the ethical implications of the new information technology).

4) The emphasis in the analysis is on the change in the people involved, presuming that structural changes, although necessary at times, lead to superficial results when carried out without corresponding direct changes in the capabilities, attitudes, aptitudes and social characteristics of the people involved. (This is done in ISAC, PIP, ID, INCAE and PROPLAN).

5) The analyst shares responsibility for defining solutions or changes which have political, financial and technological as well as economic feasibility, and for the rationalization of analytical and change activities so that they are directed to the factors which have the most to do with improving production, efficiency, efficacy and coming to terms with the crises and structural problems of the country. (This is attempted in the INCAE, PIP/LF, STRADIS AND PROPLAN, which have explicit concern for implementation strategies, but unlike the ICAP methodology, these do not have a production-oriented or crisis-resolution framework for setting priorities). (29)

6) The analysis involves the reproduction and comprehension in a model of the logic and particular rationality which underlies the values of the people involved in the production situation, and of the client of the analysis itself, in order to identify possibly useful innovations and to try to get beyond symptomatic explanations or lists of problems and closer to the critical change factors. (This is attempted in PIP/LF, ACM/PCM, and JSD, in this last case the model being built up independently of hardware or software constraints).(30)

7) The analysis is inserted into a scientific process of hypotheses formulation and testing and theoretical developments, so that it takes advantage of the accumulation of relevant knowledge up to the moment and offers a credible contribution to this accumulation. Also, as Checkland writes, "The activity we call 'science' happens to be the most powerful means we have of making valid some of our intellectual constructions, our notations, by checking them against the real world itself."(31) This activity assures coherence in the models, and is a big help in assuring relevance (by controlling spuriousness). Practically, this involves the systematic and agil mining of existing sources of relevant information, by means of well-focused bibliographic search, and factor analysis and taxonomy-construction on data tables and data bases, in order to develop adequate hypotheses and data comparison. It also means considerable rigor in the construction and conceptualization of the model for the analysis and a faithful representation of this conceptualization in it's operationalization for field research. (The use of scientific method as a control on coherence and relevance is attempted in ID and SSM, although these do not systematize the search, selection and use of existing documents and data).

8) The analysis itself involves experimentation or simulation of the proposed changes, or at least a careful evalution of the disposition in the people and environment for a real change and a preparation for it. When large investments have to be made, as in a new large computer, and action research techniques of experimentation and of "trial and evaluation" are not appropriate, simulation is advised. Input improvements and user capabilities should be tested, for example, before incorporating a new large processing system. At any rate, these changes will produce benefits immediately and will be necessary if the new large processing system, when it is installed, is to be efficacious. (Learning by doing is basic in PROPLAN).(32)

9) Both the information system being analyzed and the analysis itself are means of creating knowledge, based on both external and

internal sources of information, and should be compared with other means like training of existing personnel, recruitment of new personnel, technical cooperation, workers' participation and the alternatives of researching or setting up an information system to generate and process the information. (This comparison of alternatives to information systems is an element of ISAC, although it gives very little orientation on this).

10) To the extent possible, all solutions or changes should be considered tentative and exploratory, and should involve the transfer of analytical and self-correcting capabilities to the "subjects". (This is attempted in the ISAC, INCAE, PIP/LF and PROPLAN methodologies).(33)

These ten principles respond rather directly to many of the observations made about the different ways in which current systems analysis is deficient. It is promising to see that there are some information and organizational systems methodologies which incorporate one or more of these principles, but none of them with the exception of the Soft System Methodology, PROPLAN and that of ICAP make this linkage explicit and it is apparent that in the construction of most methodologies, the issues raised in this article simply have not been addressed.

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(1) C. West Churchman, THE SYSTEMS APPROACH AND ITS ENEMIES, New York: Basic, 1979; Ludwig von Bertanlanffy, GENERAL SYSTEM THEORY: FOUNDATIONS, DEVELOPMENT, APPLICATIONS, New York: George Braziller, 1968; T. Downing Bowler, GENERAL SYSTEMS THINKING: ITS SCOPE AND APPLICABILITY, New York: Elsevier North Holland, 1981; Ervin Laszlo, THE RELEVANCE OF GENERAL SYSTEMS THEORY, New York: George Braziller, 1972.

(2) Technical rationality is the ordering and weighting of alternatives or options according to values which respond to a dominating paradigm in a given discipline, sector or field. Paxy Fernandes, Pavle Sicherl and other authors differentiate political and technical rationality, or such analogies as public and enterprise (productive) dimensions of corporate activity, but this presumes that one can identify "more" or "less" political power and authority considerations in sets of values which are set forth. On the contrary, all sets of values, including those which are justified in terms of technical rationality, when promoted or set forth in concrete situations, have political power and authority origins and implications.

(3) See Warren Crowther, "Tailoring information strategies for developing countries: Some Latin American experiences", expanded version of paper presented at the 1984 annual meeting of ASIS.

(4) Churchman, op.cit. This list of nine deficiencies was drawn up first and then compared with Churchman's characterization of the systems approach, only to find the coincidence very striking.

(5) "Information values" depend on the user and the specific use or production situation, and refer to the corresponding particular qualities, contents, biases and amount of abstraction or evaluation of the information. Homer Hall, "Patterns in the Use of Information: The Right to be Different", JOURNAL OF THE ASIS, March 1981, 103-112. Also, Hall, SERVICES FOR THE ANALYSIS AND EVALUATION OF INFORMATION, Final Report for the National Science Foundation Division of Information Sciences and Technology, 1982.

(6) There is something to be said for the argument that the analyst should not diagnose a whole situation in terms of all possible explanations, and that his goal is not one of scientifically explaining the causes of the problems, since the intention is only to identify the factors which have proven useful in overcoming the problems. However, this pragmatic emphasis on analyzing only what is necessary to improve the situation should not be an excuse for being less scientific in generating good hypotheses regarding the fundamental problems and the most efficacious solutions, and in contrasting these hypotheses with carefully selected evidence.

(7) Do the systems criteria posit to what extent the system is resolving the society's problems or to what extent the society is adapting the system requirements?

(8) "To look at two homogeneous members of a homogeneous epistemic community and to be interested in the fact that they can 'communicate effectively' with one another on certain topics is to miss what is at issue almost entirely. They can do so because they have been 'programmed' to be able to do so, and both to give and to receive mutual validation for doing so." Lee Thayer, "Communication Systems", in Ervin Laszlo, THE RELEVANCE OF GENERAL SYSTEMS THEORY, New York: George Braziller, 1972, 118-119.

(9) On tacit knowledge, see: Michael Polyani, THE TACIT DIMENSION, New York: Doubleday, 1966); Robert Krone, SYSTEMS ANALYSIS AND POLICY SCIENCES: THEORY AND PRACTICE, New York: John Wiley & Sons, 1980. Hall, op.cit., mentions that the analyst must have the ability and the user the willingness "to recognize and escape from pre-formed conclusions" if the information is to open new options or points of view.

(10) The choice among these information support roles is not resolved simply by insisting on formal agreements as a base for system design and pre-defined directives for system functioning. The policy implementors who need information support constantly receive chaotic and contradictory directives, and their management challege is precisely that of sorting out these directives and acting the best they can, often in partial compliance with some of them. Xinia Picado and Warren Crowther, "El control en el Sector Público: Administración es más que control, control es más que información e información es más que datos", REVISTA CENTROAMERICANA DE ADMINISTRACION PUBLICA, 3 (6), 1984, 43-80.

(11) Thus it should be no surprise that very few of the so-called "control

systems" observed by the author in the public administration of 25 countries really control. Ibid.

(12) Thayer, op.cit, who also writes: "A communication system is comprised of the organism or the individual, together with that which is presently being taken-into-account, whether some aspect of its environment or another individual or organism."

(13) While a certain amount of research has been carried out on information system and organizational changes in Latin America, this research has not been analyzed and synthesized so that it can be used to develop some basic conceptual underpinnings for analytical work. However, there is considerable evidence that many textbook premises regarding administrative changes and organizational reforms simply do not have an echo in this region. Many if not most reforms which find general acceptance in industrialized countries eventually do find their way into the developing countries, but the results of these transfers are as varied as they are regarding medical transplants. Even when widely adopted, the bureaucratic traditions assign a particular significance to them. Two recent unpublished papers are helpful in conceptualizing this bureaucratic environment and its effects on administrative reforms, especially in Africa or Asia: "Bureaucratic power and administrative change", by Fred Riggs of the University of Hawaii, and "A cultural theory of management", by Michael Thompson and Aaron Wildavsky of the University of California in Berkeley. Regarding Latin America, see: Warren Crowther and Gilberto Flores, "Problemas latinoamericanos en Administración Pública y dependencia de soluciones desde Estados Unidos", in Gilberto Flores and Jorge Nef, ADMINISTRACION PUBLICA: PERSPECTIVAS CRITICAS, San José, Costa Rica: ICAP, 1984, 59-90. A contrary view, based on African research, that a lot of existing organizational theory is in fact applicable in the Third World, is offered by David Leonard, REACHING THE PEASANT FARMER: ORGANIZATION THEORY AND PRACTICE IN KENYA, Chicago: University of Chicago Press, 1977.

(14) The proceedings of the ASIS/Egyptian Society for Information Technology conference in 1982 include a number of documents which come to terms with this problem. See especially: Aadel K., El-Dweini, "Problems and prospects in marketing of information services in Egypt", 277-92; Claudia Boycott, "Information System Development of a Rural American Community: Parallel with 'Informatization' of Developing Nations", 535-40; and Amar Gupta, "Adapting the Informational Revolution", 105-112, in Bahaa El-Haddy, ed., THE INFRASTRUCTURE OF AN INFORMATION SOCIETY, Amsterdam: North-Holland, 1984.

(15) This is related perhaps to user sophistication more than managerial preocupations. In a study of computation in U.S. local governments, the factor most correlated with executive support for new systems is the present personal use of computer reports, even to the point of overlooking technological and organizational problems of the present computing system or thinking that these will somehow disappear. James L. Perry and Kenneth Kraemer, TECHNOLOGICAL INNOVATION IN AMERICAN LOCAL GOVERNMENTS/THE CASE OF COMPUTING, New York: Pergamon, 1979, 115.

(16) Perry and Kraemer, opo.cit., 63-9.

(17) On action research in general, a particularly fine and critical

evaluation of it is: Simposio Mundial de Cartagena, CRITICA Y POLITICA EN CIENCIAS SOCIALES: EL DEBATE SOBRE TEORIA Y PRACTICA, Bogota, Colombia: Punta de Lanza, 1978, 2 vol. In English, one may consult: Budd Hall, "Participatory Research: Expanding the Base of Analysis", INTERNATIONAL DEVELOPMENT REVIEW FOCUS, 1977, 23-8; Paulo Freire, RESEARCH METHODS, Dar es Salaam: Institute of Adult Education, 1974. A very good introduction to action research applied to the analysis of organizational problems, along with the presentation of a methodology, is found in: Peter Checkland, SYSTEMS THINKING, SYSTEMS PRACTICE, Chichester, John Wiley & Sons, 1981; see also, ICAP, MANUAL DE ANALISIS ADMINISTRATIVO, San Jose, Costa Rica: ICAP, 1985 and Warren Crowther, CIENCIA, RELEVANCIA Y VIABILIDAD EN EL ANALISIS ADMINISTRATIVO, San Jose, Costa Rica: ICAP, 1983; Gerald Susman and Roger Evered, "An assessment of the scientific merits of action research", ADMINISTRATIVE SCIENCE QUARTERLY, 23, December 1978, 582-603.

(18) Warren Crowther and Flor Cubero, APUNTES PARA LA ELABORACION DE ESTRATEGIAS DE INFORMACION PARA LAS INSTITUCIONES EN EL SECTOR PUBLICO, San Jose, Costa Rica: ICAP, 1983. IAE (information analysis and evaluation) is not included in this comparison, since it is not a system design methodology, but it does have in-built system re-design or maintenance function based on a lot of the action research principles.

(19) Checkland, op.cit..

(20) Mats Lundenberg, Göran Goldkuhl and Andres Nilsson, INFORMATION SYSTEMS DEVELOPMENT: A SYSTEMATIC APPROACH, Englewood Cliffs: Prentice-Hall, 1981; evaluated and compared with other methodologies in: T.W. Olle, H.G. Sol and C.J. Tully, INFORMATION SYSTEMS DESIGN METHODOLOGIES: A FEATURE ANALYSIS, Amsterdam: North-Holland, 1983; and R.N. Maddison, INFORMATION SYSTEM METHODOLOGIES, Great Britain: Wiley Hayden, 1983.

(21) Reviewed and compared with other methodologies in Olle, et. al, op.cit.; and in Maddison, op.cit.

(22) Reviewed and compared with other methodologies in Maddison, op.cit.

(23) The INCAE methodology is taken from various sources, each of which deal with different aspects of it: John Ickis, "Modelos de intervención para el desarrollo institucional: la experiencia de INCAE", REVISTA INCAE, II (1 y 2), 1983, 49-72; Marc Lindenberg and Benjamin Crosby, MANAGING DEVELOPMENT: THE POLITICAL DIMENSION, New Brunswick: Kumarian, 1981; John Ickis, "Structural responses to new rural development strategies", in David Korten and Felipe Alfonso, BUREAUCRACY AND THE POOR, West Hartford: Kumarian, 1983, 4-32; John Ickis, "El grupo de escritores de casos", REVISTA INCAE, II (3,4), 1984, 69-82.

(24) United Nations, Department of Economic and Social Affairs, GUIA PRACTICA PARA MEJORAR DE FORMA PROGRAMADA EL RENDIMIENTO DE LAS ORGANIZACIONES PUBLICAS, reproduced in SELECCION DE DOCUMENTOS CLAVE, of the Latin American Center for Development Administration, 2 (1), junio 1985. PIP is a Management by Objectives (MBO) approach. MBO is participatory but it lacks a real focus on behavior. It is goal-oriented, but it lacks strategy and follow-through. See: Gary Brumback and Thomas McFee, "From MBO to MBR", PUBLIC ADMINISTRATION REVIEW, 42 (4), July/August 1982, 363-70. The Logical Framework is in this sense a complement, with

its emphasis on contingencies. It's best for organizing evaluation criteria in control systems. Practical Concepts Incorporated, THE LOGICAL FRAMEWORK: A MANAGER'S GUIDE TO A SCIENTIFIC APPROACH TO DESIGN AND EVALUATION, Washington, PCI, 1979.

(25) Francois Hetman, SOCIETY AND THE ASSESSMENT OF TECHNOLOGY, Paris, France: OECD, 1973, 226-234; an "informal delphi" with emphasis on group discussion more than individual inputs is presented by George Honadle, RAPID RECONNAISSANCE APPROACHES TO ORGANIZATIONAL ANALYSIS FOR DEVELOPMENT ADMINISTRATION, Washington: Development Alternatives Inc., 1979.

(26) Leslie Roos, Jr. and Roger Hallm, "Influence diagrams and organizational power", ADMINISTRATIVE SCIENCE QUARTERLY, 25, March, 1980, 57-71.

(27) Project on Management for Rural Development in Latin America, A GUIDANCE SYSTEM IMPROVEMENT EFFORT: PROPLAN/A CCOPERATION WITH THE COLOMBIAN DRI PROGRAM, San Jose, Costa Rica: Inter-American Institute for Cooperation on Agriculture, 1983.

(28) It is often convenient that a contract is made between the analyst and the object institution or working unit (even if this latter is of the same institution as the analyst), so that it is clear exactly what participation is expected of the clients and "subjects", and what can be expected regarding the results of the analysis.

(29) The "production chain" model used in the ICAP methodology is highly influenced by two other production-oriented analytical models: the Added Value Diagram of Enrique Soto Borbón (ORGANIZACION Y PROGRAMACION: ENFOQUE SISTEMICO, Third Edition, San José, Costa Rica: ICAP, 1984) and the Chain of the Economic Commission for Latin America of the United Nations: EL MODELO DE CADENA DE DISTRIBUCION COMO INSTRUMENTO METODOLOGICO, E/CEPAL/1045, Santiago, Chile: ECLA, 1977).

(30) A particularly innovative methodology for this is that of Jorge Roulet, "Diseño e implementación de un Programa de Reforma Administrativa: El Caso de la Dirección de Vivienda de la Provincia de Catamarca", in SELECCION DE DOCUMENTOS CLAVES, of the Latin American Center for Development Administration, 2 (1), junio 1985, 63-140.

(31) Checkland, op.cit., 248.

(32) On simulation as an analytical tool, see: E.S. Quade, ANALYSIS FOR PUBLIC DECISIONS, 2nd Edition, New York: North-Holland, 1982, Chap. 10.

(33) A framework for conceptualizing the capacity-building approach is offered by Beth Walter Honadle, "A capacity-building framework: A search for concept and purpose", PUBLIC ADMINISTRATION REVIEW, 41 (5), September/October 1981, 575-80.